

# Comparison And Analysis of Physicochemical Properties of Homemade Grape Juice and Commercial Juices Available in The Local Markets in Erbil City

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## Abstract

*Grapes (Vitis vinifera L.) belong to the family Vitaceae that are the best source of energy. The objective of this study was to compare the physicochemical analysis and sensory evaluation of natural fresh grape juices and two branded grape juice. Three treatments were evaluated, consisting of combinations between natural fresh grape juice and two branded grape juice. Approximately one liter of juice was obtained per treatment. Analyses of moisture content, pH, titratable acidity and total soluble solids Brix. The physicochemical properties of moisture content, pH, titratable acidity and total soluble solid (TSS) showed diversity among genotype with range of 81.694 to 89.924 present, 3.60 to 4.64, 0.817 to 1.117 percent and 6.7 to 17.1 °Brix respectively. As well as, sensory evaluation was conducted. There was a significance difference ( $p < 0.05$ ) between the natural and branded grape juice samples in the appearance, aroma, colour, taste, texture and overall acceptability.*

**Keywords:** Natural grape juice; Branded grape juice; Physicochemical composition; Sensory evaluation.

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## 1 INTRODUCTION

The grape (*Vitis* spp.) is one of the most economically important species of plants due to its various uses in the production of wine, grape juice and other food products. Grape crops are one of the main agricultural activities in the world, with more than 60 million tons produced annually (Teixeira et., 2014). Historically, the production and export of grapes were controlled almost exclusively by traditional European countries, however, in recent years, South America has shown significant growth rate of the production and export of grapes with two harvests per year (Sousa et al., 2014). Grape juice is one of the most consumed juices, due to its pleasant sensory acceptance related to flavor, aroma, color and freshness (Granato et al., 2016). Another factor that popularized the consumption of grape juices is its functional properties in vitro and in vivo, and potential health benefits (Mcgill et al., 2013; Toaldo et al., 2016). Grape juice is consumed worldwide and is considered an important source of phytochemicals, such as anthocyanins, biogenic amines, and polyphenolic compounds (Burin et al., 2010). However, grape fruits and juices are among the most important nutrient dense foods (Rampersaud, 2007). They contain a range of important nutrients for human health such as vitamin C, vitamin A, minerals and phytochemicals including flavonoids, carotenoids, glucarates, coumarins, terpenes and limonoids (Zhang, 2007). Regarding the chemical composition, the grape has a plurality of substances: phenolic compounds such as the anthocyanins, catechins, quercetin, resveratrol and phenolic

acids; amino acids and proteins, potassium, sodium, glucose, fructose, and minerals. It is well known that the concentration of polyphenols is greater in purple grape juices than in whites, since that dark colored grapes have higher contents of phenolic compounds and antioxidant capacity (Granato et al., 2016). Grape juice consists of water (81%–86%) which makes grapes juicy in nature and a high concentration of sugars (glucose and fructose) with high acidity owing to the presence of organic acids that balance the sweet and sour taste (Sharma et al., 2018). The grape juice is recognized for a combination of sweetness and acidity taste which makes it appealing to humans (Kersh et al., 2023). Many people consume the juice when they are in the season and a lot of postharvest losses make them unavailable during the off-season. Grape juice has been widely studied due to the presence of phenolic compounds and its potential beneficial effect on human health. The intake of foods rich in polyphenols has contributed to slow the onset of chronic and cardiovascular diseases and cancer (Yamagata et al., 2015). The main pathways of action of polyphenols are through their anti-inflammatory activity and antioxidant capacity (Androutsopoulos et al., 2010). The objective of this work was to compare the physicochemical profile of homemade grape juice and commercial juices available in the local markets in Erbil city.

## 2 MATERIALS AND METHODS

### 2.1 Materials

The experiment was conducted in the laboratory of the department of food technology, agricultural engineering science, Salaheddin university. The grapefruits were purchased from local market in Erbil City, Kurdistan Region. The fruits were stored in the refrigerator at 10°C until needed for experiment. After that the samples were divided into three classes which are sample A was fresh natural grape juice, sample B was Sunich brand, sample C was Tazech brand, sample D was Zaki, sample E was Mogo and sample F was Rani. The materials and equipment used for the Laboratory work include: grape fruits, plastic class, pH meter, analytical weighing balance, refractometer, sensory evaluation cups, masking tape, oven, petri dish, desiccator, tong, conical flask and burette for titration.

### 2.2 Methods

The grape fruits were washed with distilled water, peeled manually with sharp knife and cut into halves. Each half of the fruit was pressed and fresh juice obtained using the household blender, each half of the fruit was blended in a Moulinex blender without addition of some water. The fruit juice was filtered using a sieve and the clear juice immediately analyzed in triplicates for the proximate, nutritional compositions and sensory evaluation.

### 2.3 Determination of moisture content

The moisture content was determined according to the (Szabadvary, 2016) method. when 10 g sample was weighed in a pre-weighed ceramic crucible and dried in an oven at 105°C for 24 h. The dried sample was then cooled to room temperature in a desiccator and weighed. The percentage moisture content was calculated by the following formula.

$$\% \text{ Moisture} = \frac{W_1 - W_2}{W_1} * 100$$

Where:

$W_1$  = Initial weight of sample;  $W_2$  = Weight of the dried sample.

#### 2.4 Determination of pH value

The pH was monitored by using a digital pH meter. In order to determine the pH of sample, juice of grapes was prepared in a blender. This was measured using a Seven Easy Mettler Toledo pH meter that had been calibrated with a buffer solution at pH 7.0 and 4.0 (Mettler Toledo, Switzerland) (AOAC, 2008).

#### 2.5 Determination of Titratable Acidity (Ta)

To determine titratable acidity, five mL of grape juice was taken in a 250mL flask and diluted with 50mL of distilled water. Three drops of 1% phenolphthalein were added. The juice was then slowly titrated with 0.1N NaOH (Munir, 2017). The percentage of tartaric acid was determined in the grape juice sample was calculated thus:

Titre value  $\times$  0.075  $\times$  100% Titre value = Volume of sample solution used Where; 0.075 is a conversion factor.

#### 2.6 °Brix Determination

The Brix value (sugar content) of the grape juices was determined by using a refractometer. The sample plate was cleaned and dried. A few drops of the sample were placed on the plate, which was then closed. The refractometer was held up to a natural light source and the reading was recorded (Burin et al., 2010).

#### 2.7 Sensory Evaluation

Sensory evaluation was carried out using nine (9) point hedonic scale described by (Ihekoronye and Ngoddy, 1985), where 15 untrained panelists were used taste and score the coded samples and assessed by ten assessors (including students in Food Technology Departments). A test form questionnaire comprising five sensory attributes, namely, appearance, color, aroma, taste and overall acceptability, was given to each of the assessor.

#### 2.8 Statistical analysis

The statistical analyses were performed using the SPSS (Statistical Package for the Social Sciences, version 22.0) program. The analysis of variance which consisted of univariate analysis was performed followed by Duncan test. One-way analysis of variance (ANOVA) was used to compare means at the significant level  $p < 0.05$ . All analyses were performed with replicates.

### 3 RESULTS AND DISCUSSION

#### 3.1 Physiochemical analysis of the grape juice samples

The physiochemical properties of the grape fruit juice samples are presented in Table 1. The moisture content of the fruit juice is an index of the water content. The natural squeezed fruit juice which is sample (A) had the lowest moisture content ( $81.694 \pm 0.08\%$ ) while the Sunich and Tazech recorded highest moisture content with ( $89.924 \pm 0.01\%$ ) and ( $83.939 \pm 0.02\%$ ) respectively. The moisture contents of the grape juice were lower than the corresponding values for grape juice that reported by (Kolawole et al., 2017).

The pH of the natural and branded sample are significantly different the highest pH values was obtained in natural grape juice sample (D) with ( $4.96 \pm 0.32^a$ ), while for the branded samples the pH values were displayed lowest value which are ( $3.55 \pm 0.19^a$ ) and ( $3.60 \pm 1.01^{ab}$ ). The pH is not a parameter required by legislation; however, it is important due to its influence on the color and stability of anthocyanins (Malacrida and Motta, 2005). Cosme et al., (2018) ranged the pH from 3.23 to 4.50 among the natural and branded samples, which is compatible with the results obtained in the present work.

The titrable acidity parameter showed statistical significance among the natural and brand grape juice samples, the natural grape juice had lowest acidity with ( $0.817 \pm 0.21\%$ ) whereas the branded samples had higher acidity with ( $1.065 \pm 0.01\%$ ) and ( $1.117 \pm 0.10\%$ ) respectively. Vara et al. (2019) observed titrable acidity of seven samples that ranged from 0.49 to 0.8, those being low numbers when compared to the present work.

The soluble solids content varied between natural and branded samples; The lowest values were obtained in the juices of the Tzech and Mogo brand  $6.7 \pm 0.37^b$ ,  $6.5 \pm 0.24^b$  °Brix respectively while the highest value was  $17.1 \pm 0.19^a$  °Brix in Sunich brand. However, the juices obtained from fresh grape showed lower values of soluble solids compared to the branded samples with  $14.1 \pm 0.28^a$  °Brix. The soluble solids content of grape juices obtained from nine cultivars varied from 17.53 to 21.00 °Brix (Bender et al., 2021).

**Table 1: Physicochemical analysis of the grape juice samples**

Samples	Parameters			
	% Moisture	pH value	% Total Acidity	°Brix
A	$81.694 \pm 0.08^a$	$4.64 \pm 0.11^a$	$0.817 \pm 0.21^{ab}$	$14.1 \pm 0.28^a$
B	$83.939 \pm 0.02^a$	$4.24 \pm 0.10^a$	$1.065 \pm 0.01^a$	$17.1 \pm 0.19^a$
C	$89.924 \pm 0.01^{ab}$	$3.60 \pm 1.01^{ab}$	$1.117 \pm 0.10^a$	$6.7 \pm 0.21^b$
D	$89.234 \pm 0.11^{ab}$	$4.96 \pm 0.32^a$	$0.659 \pm 0.28^{ab}$	$14.17 \pm 0.37^b$
E	$85.872 \pm 0.27^a$	$3.55 \pm 0.19^a$	$1.174 \pm 0.11^a$	$6.5 \pm 0.24^b$
F	$84.532 \pm 0.37^a$	$4.19 \pm 0.31^c$	$1.315 \pm 0.13^a$	$17.04 \pm 0.07^b$

Where sample A= natural, B= Sunich, C= Tzech, D= Zaki, E = Mogo and F = Rani. Each value is expressed as mean  $\pm$  standard deviation (n = 3). Different alphabet superscripts in the same row indicate significant differences ( $p < 0.05$ ) according to the Duncan test.

### 3.2 Sensory Evaluation of Grape Juice Samples

In the present study, sensory parameters like appearance, aroma, colour, taste, texture and overall acceptability were considered for organoleptic study. The result of the sensory properties of the grape juice samples analyzed is presented in Table 2. From the result, the natural fresh grape juice was rated highest for appearance, aroma, colour, taste, texture and overall acceptability. However, the lower scores for appearance, aroma, colour, taste, texture and overall acceptability were indicated in sample C of Tzech brand. However, statistically significant differences were found between the scores of three samples. Grape juice is combination of good sensory (color and pleasant aroma) and health properties due to rich in phenolic compounds which encourages acceptability to consumers.

**Table 2: Sensory Evaluation of the grape juice samples**

Samples	Appearance	Aroma	Taste	Texture / mouthfeel	Overall Acceptability
A	$4.5 \pm 0.82^a$	$4.0 \pm 1.09^a$	$5.0 \pm 0.83^b$	$4.5 \pm 1.48^a$	$5.0 \pm 0.83^b$
B	$4.0 \pm 1.20^a$	$3.5 \pm 1.10^{ab}$	$4.5 \pm 2.70^{ab}$	$4.0 \pm 3.10^a$	$4.0 \pm 1.14^a$
C	$3.5 \pm 1.67^b$	$3.5 \pm 1.20^{ab}$	$4.0 \pm 1.94^{ab}$	$4.0 \pm 1.51^a$	$3.5 \pm 0.44^a$
D	$3.5 \pm 0.32^b$	$3.5 \pm 1.38^{ab}$	$3.5 \pm 0.70^{ab}$	$4.5 \pm 0.14^{ab}$	$3.5 \pm 0.21^a$
E	$4.5 \pm 0.29^a$	$4.0 \pm 1.19^a$	$5.0 \pm 0.14^b$	$4.5 \pm 0.18^{ab}$	$5.0 \pm 0.27^b$
F	$4.5 \pm 0.33^a$	$4.0 \pm 1.30^a$	$5.0 \pm 0.21^b$	$4.5 \pm 1.26^{ab}$	$5.0 \pm 0.11^b$

## CONCLUSION

In conclusion, Grape juice is a potentially good source of nutrients, vitamins and essential mineral elements. The low amount of antinutrients indicates the juice is safe for consumption. Understanding proper extraction method for the fresh grape juice extraction is important. However, biochemical and sensory characteristics of grape juice play very important role in consumer acceptance. The results that obtained from the present study concluded that Natural grape juice is found better in comparison to other branded grape juice based on yield performance as well as physic-chemical and sensory properties of juice.

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## REFERENCES

1. Androutsopoulos, V.P., Papakyriakou, A., Vourloumis, D., Tsatsakis, A.M. and Spandidos, D.A., 2010. Dietary flavonoids in cancer therapy and prevention: substrates and inhibitors of cytochrome P450 CYP1 enzymes. *Pharmacology & therapeutics*, 126(1), pp.9-20.
2. AOAC, 2008. Official methods of analysis, 18th edn., 2005. Current through revision 2, 2007 (On-line).
3. Bender, A., de Souza, A.L.K., Malgarim, M.B., Caliari, V., Kaltbach, P. and Costa, V.B., 2021. Physicochemical and sensory properties of grape juices produced from different cultivars and extraction systems.
4. Burin, V.M., Falcão, L.D., Gonzaga, L.V., Fett, R., Rosier, J.P. and Bordignon-Luiz, M.T., 2010. Colour, phenolic content and antioxidant activity of grape juice. *Food science and technology*, 30, pp.1027-1032.
5. Burin, V.M., Falcão, L.D., Gonzaga, L.V., Fett, R., Rosier, J.P. and Bordignon-Luiz, M.T., 2010. Colour, phenolic content and antioxidant activity of grape juice. *Food science and technology*, 30, pp.1027-1032.
6. Cosme, F., Pinto, T. and Vilela, A., 2018. Phenolic compounds and antioxidant activity in grape juices: A chemical and sensory view. *Beverages*, 4(1), p.22.
7. Granato, D., de Magalhães Carrapeiro, M., Fogliano, V. and van Ruth, S.M., 2016. Effects of geographical origin, varietal and farming system on the chemical composition and functional properties of purple grape juices: A review. *Trends in Food Science & Technology*, 52, pp.31-48.
8. Granato, D., de Magalhães Carrapeiro, M., Fogliano, V. and van Ruth, S.M., 2016. Effects of geographical origin, varietal and farming system on the chemical composition and functional properties of purple grape juices: A review. *Trends in Food Science & Technology*, 52, pp.31-48.
9. Ihekoronye, A.I. and Ngoddy, P.O., 1985. *Integrated food science and technology for the tropics* (pp. ix+386pp).
10. Kersh, D.M.E., Hammad, G., Donia, M.S. and Farag, M.A., 2023. A comprehensive review on grape juice beverage in context to its processing and composition with future perspectives to maximize its value. *Food and Bioprocess Technology*, 16(1), pp.1-23.
11. Kolawole, S.E., Obueh, H.O. and Emokpae, B.A., 2017. Nutritional and antinutritional evaluation of grapefruit (*Citrus paradisi*) juice using different extraction methods. *Journal of Advances in Food Science & Technology*, 4(2), pp.84-90.
12. Malacrida, C.R. and Motta, S.D., 2005. Total phenolics and anthocyanins in grape juice. *Food Science and Technology*, 25, pp.659-664.
13. McGill, C.R., Keast, D.R., Painter, J.E., Romano, C.S. and Wightman, J.D., 2013. Improved diet quality and increased nutrient intakes associated with grape product consumption by US children and adults: National Health and Nutrition Examination Survey 2003 to 2008. *Journal of food science*, 78(s1), pp.A1-A4.
14. Munir, N., 2017. Nutritional value assessment and proximate composition of gamma irradiated grapes. *Pakistan Journal of Science*, 69(3).

15. Rampersaud, G.C., 2007. A comparison of nutrient density scores for 100% fruit juices. *Journal of food science*, 72(4), pp.S261-S266.
16. Sharma, A.K., Somkuwar, R.G., Bhange, M.A. and Samarth, R.R., 2018. Evaluation of grape varieties for juice quality under tropical conditions of Pune region. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*, 88, pp.1517-1521.
17. Sousa, E.C., Uchôa-Thomaz, A.M.A., Carioca, J.O.B., Morais, S.M.D., Lima, A.D., Martins, C.G., Alexandrino, C.D., Ferreira, P.A.T., Rodrigues, A.L.M., Rodrigues, S.P. and Silva, J.D.N., 2014. Chemical composition and bioactive compounds of grape pomace (*Vitis vinifera* L.), Benitaka variety, grown in the semiarid region of Northeast Brazil. *Food Science and Technology*, 34, pp.135-142.
18. Szabadváry, F., 2016. *History of Analytical Chemistry: International Series of Monographs in Analytical Chemistry (Vol. 26)*. Elsevier.
19. Teixeira, A., Baenas, N., Dominguez-Perles, R., Barros, A., Rosa, E., Moreno, D.A. and Garcia-Viguera, C., 2014. Natural bioactive compounds from winery by-products as health promoters: A review. *International journal of molecular sciences*, 15(9), pp.15638-15678.
20. Toaldo, I.M., Cruz, F.A., da Silva, E.L. and Bordignon-Luiz, M.T., 2016. Acute consumption of organic and conventional tropical grape juices (*Vitis labrusca* L.) increases antioxidants in plasma and erythrocytes, but not glucose and uric acid levels, in healthy individuals. *Nutrition Research*, 36(8), pp.808-817.
21. Vara, S., Karnena, M.K. and Dwarapureddi, B.K., 2019. Natural preservatives for nonalcoholic beverages. In *Preservatives and preservation approaches in beverages* (pp. 179-201). Academic Press.
22. Yamagata, K., Tagami, M. and Yamori, Y., 2015. Dietary polyphenols regulate endothelial function and prevent cardiovascular disease. *Nutrition*, 31(1), pp.28-37.
23. Zhang JiuXu, Z.J., 2007. Flavonoids in grapefruit and commercial grapefruit juices: concentration, distribution, and potential health benefits.